In the Fourth Dimension

SAINT PAUL AND MILTON SET FORTH IN GRAPHIC ALGEBRA

NEW HAVEN, March 24.—Prof. Andrew W. Phillips, head of the mathematical department at Yale and dean of the graduate school, at a meeting of the Yale Mathematical Club last week presented an outline statement of some considerations in different dimensional spaces, together with the model of a solid which is the projection of a definite figure of fourth dimensional space.

For thirty-five years Prof. Phillips has been a teacher at Yale and he introduced on an extensive scale the study of mathematics by the aid of graphic curves and models. Not only in the elementary courses in his department but in more complex models he has made plain to the comprehension of the less advanced students many of the principles of the higher mathematics. Ever since he was a lad he has been delving into mathematics and he has spent years in evolving new models with which to present his ideas to his students.

It is said this new model and the inferences drawn from it will be interesting not only to mathematicians, but equally to others who are students of transcendental problems. It is not surprising to the friends of Prof. Phillips who know his liking for poetry and his familiarity with the Bible to find that his new mathematical demonstration has an interpretation of a passage from Milton and a text of St. Paul's.

Prof. Phillips in explaining his new mathematical demonstration made the following statement:

"There is a wonderful fascination to be found in the study of shadows, whether they be of the familiar objects with which we are surrounded, as cast by the sun, the moon or artificial lights, or be produced for practical or scientific or dramatic effects or to teach important lessons of life. Especially is the study exciting when we cannot determine the object which casts the shadow, as when we attempt to find the clouds which are projected by the sunlight on the slopes of the hills or mountains or in the case of the mirage. In the Republic of Plato we find a most gruesome allegory involving shadows, which is narrated by the philosopher to teach an impressive lesson in statecraft, and which also may be applied to teach a lesson concerning the spiritual world:

"'And now,' I said, 'let me show in a figure how far our nature is enlightened or unenlightened. Behold! human beings living in an underground den which has a mouth open toward the light and reaching all along the den; they have been here from their childhood and have their legs and necks chained so that they cannot move and can only see before them, for the chains are arranged in such a manner as to prevent them from turning round their heads. Above and behind them a light of a fire is blazing at a distance, and between the fire and the prisoner there is a raised way, and you will see, if you look, a low wall built along the way like the screen which marionette players have in front of them, over which they show their puppets.'

'I see.'

'And do you see,' I said, 'men passing along the wall, some apparently talking and others silent, carrying vessels and statues and figures of animals made of wood and stone and various materials which appear over the wall?'

'You have shown me a strange image and they are strange prisoners.'

'Like ourselves,' I replied, 'and they see only their own shadows or the shadows of one another, which the fire throws on the opposite wall of the cave.'

'True,' he said, 'how could they see anything but the shadows if they were never allowed to move their heads?'

'And of the objects which are being carried in like manner they would only see the shadows?'

'Yes,' he said, 'and if they were able to talk with one another, would they not suppose that they were naming what was actually before them?'

'And suppose further that the prison had an echo which came from the other side, would they not be sure to fancy that the voice which they heard was that of a passing shadow?'

'No question,' he replied.

'Beyond question,' I said, 'the truth would be to them just nothing but the shadows of images.'

"Plato goes on in the dialogue to consider, if one of the prisoners is liberated and is compelled to see the true light and is brought out of the cave and taught to see the objects themselves of which he had seen the shadows, how he would be dazzled and confounded by the sight.

"To take an illustration along the line of the development of this subject in hand. Suppose an intelligent creature was confined between two discs and that one of the discs was of glass and curtained so that the inhabitant could not see the objects in the world outside but could understand them only by the shadows of them cast on the curtain. Suppose the other disc was so arranged that he could draw all sorts of figures. The interpretation of his mathematical equations and expressions would involve but two dimensions, length and breadth. He might find imaginary roots of his equations and imaginary expressions which he could not interpret because there was no third dimension in his experience.

"The one dimensional creature, as an eel in a water pipe, could only interpret one dimensional algebra. It would be plus x and minus x. We in a three dimensional world may find imaginary quantities as when we plot a sphere and not be able to interpret them in our space. There are many mysteries which we encounter which might be interpreted if we were four dimensional beings in a four dimensional space.

"But to bring this down to mathematical form more strictly, let us suppose a one dimensional creature to inhabit a line world. Assume that he is free to move along his space, the line, and that he can pierce all objects with his line. A circle would to him be manifested by chords of different lengths, and he could explore a square having two dimensional space, but only to get lines.

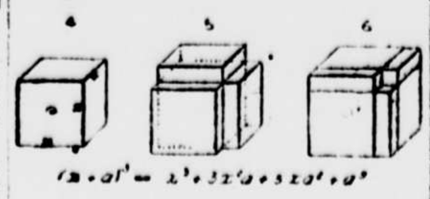
"Suppose next a two dimensional creature whose dwelling was a mathematical plane and suppose the word shadow to mean to him any manifestation in his plane, a section of a solid, a projection of a figure, as well as a shadow used in its ordinary sense; suppose him to be familiar with algebraic analysis and manipulation; that ordinary shadows and projects could be made upon it and that he could pierce all solid objects with his plane. He could not see a sphere, but he could find that its sections were circles by experiment as well as by analysis. He could not see a cube, but he could understand by experiment and analysis that sections made by his plane parallel to a side were squares, that sections parallel to an edge would be rectangles, that oblique sections might be triangles or figures of four, five or six sides.

"Let us now study a definite line of figures.

$(x+a)^2 = x^2+2xa+a^2$

"Assuming a square whose side is x, suppose this square to grow in length independently of its breadth, making the resulting growth of a rectangle on one side of length x and breadth a. Suppose the original square also to have grown in breadth independent of its length, making a similar rectangle on the top of the square. Figure 2 represents the square with these two growths, and in the equation the square itself is x^2, and the two additions are $2xa$. If then the two additions grow they will complete the square by the addition of a^2. (Figure 3.)

"Again:



$(x+a)^3 = x^3+3x^2a+3xa^2+a^3$

"Assuming a cube whose side is x (Figure 4), suppose this cube to grow in length independent of breadth and height, making the resulting slab whose sides are x long and x wide and a thick. Suppose further that the cube grows in breadth the same as it grows in length, we have a similar slab added to the front of the cube. Again, if the cube grows in height as it has grown in length and breadth a similar slab is added to the top. The result of these additions is Figure 5, and the total of these additions gives $3x^2a$, the second term on the right hand side of the above equation. Suppose again that these three slabs grow so as to fill in the corners. Each of these growths will be x long and a wide and a thick, the total being $3xa^2$, or the third term of the right side of the equation. (See Figure 6.) If now these three corner pieces grow they will complete the Figure 6, and this will be the last term a^3 of the equation.

"How would our two dimensional creature interpret the equation $(x+a)^3 = x^3+3x^2a+3xa^2+a^3$?

"His plane might pierce the cube in any way, but if he is to study the cube in the most comprehensive and symmetrical way would be to have his plane pass through three corners, as in Figure 7. Taking away the smaller piece cut off we have Figure 8. There the original cube has been pierced and makes the equilateral triangle in the centre; the three slabs have been pierced symmetrically, and the result is the shaded sections. The three corner pieces added to make Figure 6 have been pierced and each is a rhombus (see the corners of the section triangle in Figure 8). Now in the section the figure must have been reduced from a solid to a surface. Thus x^3 is projected into x^2, the degree of the term x^3 being diminished by one. Thus the equilateral triangle represents in its three sides the property of the elements of length, breadth and height. In the next term, $3x^2a$, the three shaded figures represent the sections of the added slabs. In projection this term would be reduced one degree in $x=3xa$, and each one of the shaded border stripes stands for a. Again, the rhombuses at the corner are the projection of the term $3xa^2$, and in the projection x drops one degree and the term becomes $3a^2$.

"This the section or shadow of the three dimensional figure is a representation of the expression, each term reduced one degree, or $x^2+3xa+3a^2$, each term of which should be multiplied by a constant to account for the obliquity of the projection. Since a^3 has no x in it it will not be projected, and this may be seen from Figure 7, since it is not pierced by the cutting plane. A two dimensional creature might therefore be satisfied with this interpretation of this three dimensional figure and possibly conclude that the shadows of figures in three dimensional spaces are the substances of two dimensional spaces.

"We may at this point consider the manifestation of

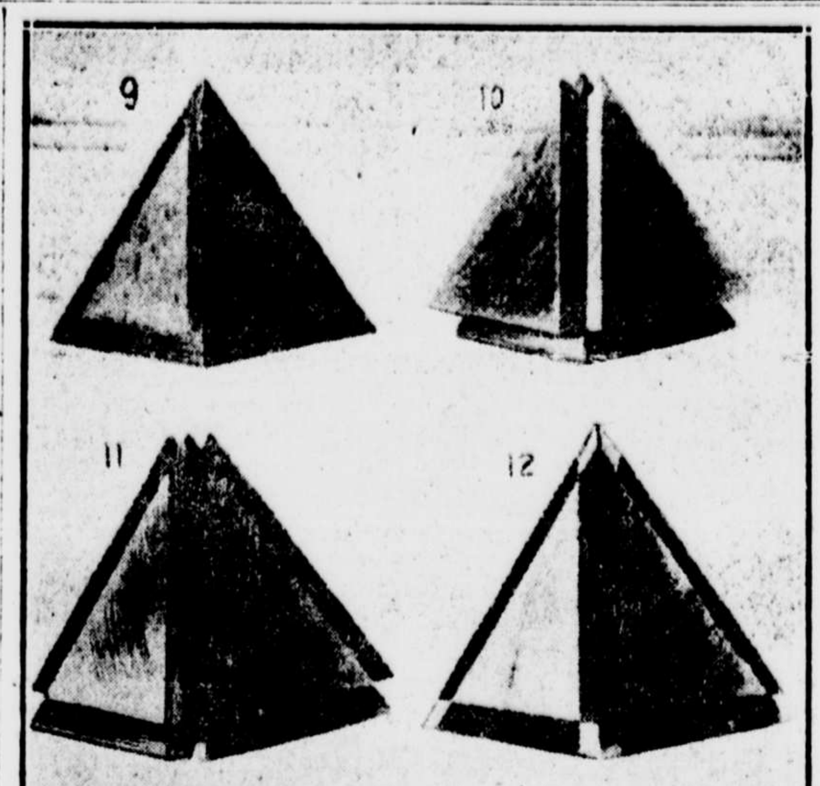
$$(x+a)^2 = x^2+2xa+a^2$$

to a one dimensional creature: Here the term x^2 would project to x and $2xa$ to $2a$, and the one dimensional creature might pierce the square from the northwest corner to the southeast in Figure 3, where the middle section of the line would represent x, and the other two sections each a.

"Let us now consider the fourth dimensional figure:

$$(x+a)^4 = x^4+4x^3a+6x^2a^2+4xa^3+a^4.$$

"Following the method of the projection of the cube, x^4 would be projected as x^3 in our space. The projection should be a four sided figure, the same as the projection of x^3 was a three sided figure. Figure 9 is such a four sided figure, a regular tetrahedron. The fourth dimensional figure should grow in four directions. Hence each side of its projection (Figure 9) should grow a slab represented by x^2a. It will be seen that each slab of Figure 10 satisfies this expression in projection, x^2 representing the surface of the side and a the thickness. Again if these four slabs grow in projection there will result (see Figure 11) the six corner pieces each represented by x long, a wide and a thick. The projection of $4xa^3$ would be each represented by a rhomboidal figure, a^3, each side the equal of a, in Figure 12. Of course it is understood that the term a^4 is left out of the projection for the reason that a^3 was left out of the projection of the three dimensional cube. We have therefore the expression in projection reduced one degree, and each term multiplied by a constant to account for the obliquity of the projector. Thus $x^3+4x^2a+6xa^2+4a^3$ represents the expression for the projection in Figure 12, in three dimensional space, of the fourth degree figure $(x+a)^4$.



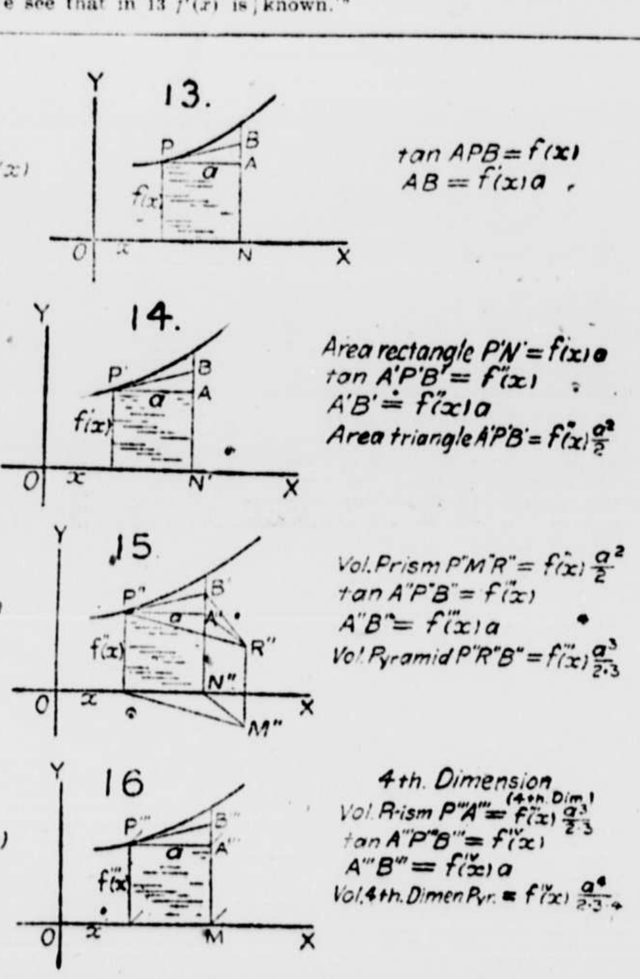
Projection of $(x+a)^4 = x^4+4x^3a+6x^2a^2+4xa^3+a^4$

"The several manifestations in the above special terms of the expansion of $(x+a)^4$ open up a wide field for speculation. We may, however, confidently assert that the manifestation or shadow (used in its most general sense) of this four dimensional figure is a solid in three dimensional space. Is it too much to conclude that in general the shadows of four dimensional space are the substances of three dimensional space? The only passage in literature which I can find at this time which seems to embody this idea is in 'Paradise Lost,' Book V., line 561:

> Thus Adam made request, and Raphael
> After short pause assenting, thus began:
> High matter thou injoin'st me, O prime of men,
> Sad task and hard, for how shall I relate
> To human sense th' invisible exploits
> Of warring spirits; how without remorse
> The ruin of so many glorious once
> And perfet while they stood; how last unfold
> The secrets of another world perhaps
> Not lawful to reveal? Yet for thy good
> This is dispensed; and what surmounts the reach
> Of human sense I shall delineate so,
> By lik'ning spiritual to corporal forms,
> As may express them best—though what if earth
> Be but the shadow of heaven and things therein
> Each to other like, more than on earth is thought.

"Another method of manifesting the fourth dimension is the following, which has not been published, but which I have used and have presented to many of you as a process for interpreting Taylor's theorum in the differential calculus. If I plot in succession $y=f(x)$, $y=f'(x)$, $y=f''(x)$, $y=f'''(x)$, it will be seen from Figures 13 and 14 that the same expression which gives a line AB in 13 gives the surface of a rectangle in Figure 14; that the expression which gives the triangle in 14 gives the prism in 15 and what gives the pyramid in 15 gives the four dimensional prism of 16. This might be continued to fifth and higher dimensions indefinitely. We see that in 13 $f'(x)$ is the tangent of APB, while it is the ordinate of the curve in Figure 14, and so on for the series, and that in two dimensional space (triangles) we multiply the base by half the height, in three dimensional space the base by one-third the height and in four dimensional space the base (which is a three dimensional solid) by one-fourth the height, for the volumes of the respective pyramids. It may also be observed that the curve, the tangent of A'''P'''B''', the lines A'''P'''$=a$, and F'''(x) in figure 16, are all as if laid down on a ground glass window.

"We do not know the shape of the four dimensional prism and pyramid behind the window in this figure beyond this plane. We may, however, apply St. Paul's words, First Corinthians, xiii., 12, to this fourth dimensional figure: 'For now we see through a glass darkly, but then face to face. Now I know in part, but then I shall know even as I am known.'"



The Bomb That Miscarried

Adventure of the Subway Guard Who Posed as a Grand Duke.

The police of the West Forty-seventh street station were surprised on Saturday by a visit from Mrs. Amelia Flyppe, who keeps a boarding house in West Forty-ninth street. Mrs. Flyppe, wearing a green percale bonnet trimmed with passementerie, approached the lieutenant at the desk who was busy entering assignments, and said:

"The young man in my hall bedroom on the third has dropped clean out of sight. He disappeared at 7.09 o'clock this morning. I would not greatly care did he not owe me $3, last week's rent. He is a subway guard and it ought not to be difficult to find him. His disappearance was followed by several circumstances indicative of actual violence as well as [illegible], which in his case would of course signify nothing. I shouldn't worry [illegible]. At 7.09 [illegible] the morning the old bookkeeper in the hall bedroom on the second floor and indeed every one of my select and [illegible] boarders was awakened by a loud [illegible] on the third floor, directly over the bookkeeper's head.

"Then came two lesser thumps, as if a [illegible] jumping clear of the floor twice, [illegible] 'Grand Central next!' and a scurry [illegible] apparently on the fire escape [illegible] being just awake there was [illegible]. At length, ten minutes later, attired in [illegible] wrapper, I knocked on the subway [illegible]. There was no answer. [illegible] knocks I opened it. [illegible] I found nothing strange about [illegible]. That is all."

[illegible] and Mrs. Flyppe [illegible]. The head detectives [illegible] Central Office [illegible] was detailed to the [illegible] Central Office man at once to Mrs. Flyppe's house and made a careful survey of the third floor hall bedroom which the subway guard had so hastily quit. The landlady could not refrain from sniffs indicative of her feelings as she saw him poke over her lost boarder's few belongings.

The detective asked her if the guard had always had the alarm clock on the dresser. Mrs. Flyppe said that she did not know. She did not recall having seen it before, but probably he had purchased it for use within a few days.

"Ah, no," dissented the detective, "for it is an old battered alarm clock."

"Well, like as not he got it at a second hand store," said Mrs. Flyppe, sniffing three times quite loud as the detective whipped out a microscope and began to examine the fire escape, which had evidently been used lately, as three milk bottles stood upon it and the vine that partly covered it was torn.

"There is little to be learned here," said the Central Office man after a prolonged study with his glass. "It seems plain though from the position of the rips and tears in the vine that two persons have been up and down here—one man came up and went down and then another [illegible] of course, went down. [illegible] Ah!" he pointed to a bit of dried mud on a step of the fire escape, "this was left by your boarder. When he fled from his room he did not have on his feet fresh mud from the street."

"Well, I don't know," observed Mrs. Flyppe. "He was always very careless about wiping his feet when he came in. I used to go to the door when I heard him coming and call down 'Watch your step!' and then he'd [illegible] to glance at his feet and think to wipe them."

The detective was peering at some books on the shelf in the room.

"Stupid!" the landlady heard him [illegible].

At once she bridled.

"Oh, pardon me. I was talking to myself," the detective said apologetically. "I was just wondering what a subway guard wanted of the 'Almanach de Gotha' and this very authoritative work on the Russian Grand Dukes."

His fingers were racing through the pages of the latter book. Suddenly they stopped and he read:

"Le Grand-duc Dmitri-Pavlovitch, ne a Ilinskoie pres de Moscou 6 Septembre 1891 vieux style, chef du régiment de gren. Fanagorie. * * * The Grand Duke Dmitri Pavlovitch will be 20 years old this year. He is a bored young man with highly reactionary tastes, though not an officer of the Preobrajenski guard."

The detective gave a little, glad cry.

"There we have it!" he exclaimed. "Did your boarder ever say aught of the Preobrajenski guard?" he demanded, turning to Mrs. Flyppe.

"Only the subway," replied the landlady firmly.

"Bring me last night's paper," Flinders commanded. "And call a small boy with a red tasselled nightcap and a blue sweater whom you will see standing whistling on the corner."

Mrs. Flyppe, pausing only to sniff a little of her disdain, obeyed him. Seizing the paper from her hands the detective turned to the inner pages and scanned them closely. He found what he wanted and read aloud:

"The police last night arrested one man for drunkenness after an anarchist's meeting in [illegible] Terrace street. In the night court he was fined $3."

"Vladimir," said Flinders to the small boy who stood before him twirling his nightcap by its red tassel. "Go bring me that man named Arturo Alfredo Ivanovitch Dolgoruky."

The boy saluted and with a Cossack yell in B major slid down the banisters and far away. The detective turned to the window and parting the lace curtains watched the street. Mrs. Flyppe stood, her hands on her hips, beside him. As he watched the street with an abstracted air the Central Office man said, as if to himself:

"There are no crimes so simple to trace, so difficult to prove as those of the group, crimes where more than two persons participate. Most of them are transparent to one who has made the slightest study of them. So few of them are successfully executed it is the most difficult thing in the world rightly to trace every man's part in them.

"On the other hand, just because there are so many participants, they seldom succeed in the execution. This one did not. It would perhaps have succeeded if the participants had kept sober, but they did not. If it apparently would have succeeded in spite of their artificial state if a few of the greatest humorist in all New York and the most interesting man in all New York had not taken a hand in it."

"Who is he?" asked the landlady sharply.

"Arturo Alfredo Ivanovitch Dolgoruky," replied the detective with a glance at her. His eye strayed to the street outside and he gave a low whistle.

"What lovely luck!" he muttered. "Not only does the criminal return to the scene of his crime, but in this case the innocent bystander finds himself too fascinated to stay away. We will now interview Grandpa Deexions, late of Dutchess county, who sold his farm and came to New York to live an artless if premeditated life in a hall bedroom just like this on an income of $1,000.50 a year from Government bonds."

A minute later Flinders had ushered the grim looking old fellow who had been staring at the boarding house into Mrs. Flyppe's parlor. Grandpa Deexions stood rather stiffly before the Central Office man, his foliated false beard quivering slightly, the only sign of nervousness he gave.

"Now, Grandpa," said Flinders easily, "pray don't be alarmed. Of course when you went to the meeting of the Commune last night you didn't know that with that beard you'd be mistaken for Czsky, the Russian nihilist. I hope they didn't because you don't look much. Any one else would have given himself away, but I know you didn't spoil their delight by disillusioning them."

"No, no. Came purty near it. Hadn't been that they all got drunk don't know's I could 'a' kep' it up and out'n it," replied the retired farmer. "Won't never take no such resk agin. Just thought as I'd like t' see an anarchy meeting. Won't no more."

"Who was the man who went up the fire escape here with the bomb?" queried the Central Office man.

"Ain't a-going to mix me up in it, be ye?" quavered the old man. "Ain't a-going to consarn me with it, be ye?"

"No, no, no," the detective reassured him. "I knew long ago you were only the innocent bystander."

Grandpa Deexions hesitated.

"Can't begin to remember his name," he confessed at last.

"Was it Dolgoruky?" asked Flinders.

"That were it," assented the old fellow eagerly. "But how's it happen they ain't no damage done here?"

"You'll learn that in about ten minutes," said the detective, who had been looking out the window.

A moment later the doorbell rang and Mrs. Flyppe ushered into the parlor the small Russian boy and a tall, wonderfully handsome man with the dead white skin of a Russian of the higher class and the brown, gold streaked hair of an Italian of Piedmont. This man smiled slightly as he bowed to the detective, bowed with a fine grace and commenced to speak slowly in French that a Parisian would have understood and a native of St. Petersburg would have envied.

"But what has become of him?" asked Flinders in English, not caring to exhibit his French alongside of the other's.

Arturo Alfredo Ivanovitch Dolgoruky laughed a short reply.

"Just plumb scared, eh?" commented the detective. "Well, I don't wonder. Hereafter he will be just a subway guard all the time, I fancy. And that'll be more honest than posing as a member of that modern Prætorian Guard of Russia, the Preobrajenski. The case is now complete and I am ready to explain it to you from beginning to end. The others here can supplement my synthetic narrative with any interesting details I overlook.

"Your boarder, the subway guard, was a young man of 20, a handsome fellow of Russian parentage, though his father was but a moujik or peasant. He went with a set of fellows of his own age, mostly Americans, and made himself out to be the Grand Duke Dmitri Pavlovitch of Russia, who is about his age.

"It was a crude sort of deception, but it worked among his friends. He knew the names of the various Russian grand dukes. As Dmitri Pavlovitch he referred to the Palace Ilinskoie near Moscow, where he was born, and to the regiments, especially the Grenadiers de Fanagorie, with which he was connected. But his silly, harmless bluff has met with more success than he had never expected.

"The local band of anarchists heard of him under his aristocratic if ridiculous disguise, and as anarchists are the most credulous of human beings they determined to blow him up. They sent him several threatening letters, which frightened the wits out of him.

"He ceased to announce himself as a Grand Duke but that only made the Communists more suspicious than ever. He had boasted himself before to be an officer of the very exclusive Preobrajenski Guard in St. Petersburg. Now the Grand Duke Dmitri Pavlovitch is not an officer of the Preobrajenski Guard, as the 'Almanach de Gotha' will show you in a minute. The anarchists got only the word 'guard' and even after he appeared only as a subway guard they still kept up their early view.

"Last night the Commune held a meeting. It was decided to deliver a bomb to your boarder, who was more of a Grand Duke to them than ever. Of course as the meeting progressed and more whose part got more drunk. A bomb was prepared and carefully wrapped and given to Mr. Dolguruky here to deliver.

"Some of the anarchists whose legs still held under them proceeded with him to your back yard and watched him climb the fire escape, place the bomb in your boarder's room and come down again. He carefully put a battered but working alarm clock in place of the bomb setting it for 7 o'clock in the morning."

"In making the bomb," interrupted Dolguruky, "I had taken pains to leave out the explosive so that there was no danger from it anyway."

"Precisely," assented Flinders. "Mr. Dolguruky rejoined the unsteady enemies of order in your back yard, Mrs. Flyppe, and they all went home, where they much needed to go; all, that is, except the fellow who was arrested and fined $3 in night court.

"What happened then? At nine minutes after 7 o'clock the alarm went off with a vim. It awakened your subway guard. He rolled out of bed, jumped twice to the ceiling under the impression that he was getting the bell cord and cried out, 'Grand Central next,' before he was fully awake.

"Then he glanced toward the dresser and saw a gleaming, round, metallic object that hadn't been there when he went to bed. Instantly he thought of the threatening letters. This was the bomb! He fled down the fire escape without much on and really I doubt if he comes back."

The doorbell rang and the beard of Grandpa Deexions shook strangely. A moment later a servant ushered into the parlor a young man in an Interborough uniform, who looked around angrily.

"What's all this?" he demanded, "and what's become of my cousin?"

"Who are you?"

"A cousin of the man who lived here, Dmitri Pavlovitch, namesake of the Grand Duke Dmitri and his ward," was the quick answer. "Where is he? Ohé!"

He gazed intently at Grandpa Deexions and then at [illegible] reached him and snatched off the old man's beard. "This is the old fellow who [illegible] to step lively and who [illegible] his number, looked [illegible] his true identity and was silenced with 1,000 Russian 4 per cent gold bonds. Old fellow, where is my cousin?"

"I seen him run daown th' street in his nightshirt," piped Grandpa Deexions. "So I pinted him out to a perliceman so's it was locked up. An' those Rooshian bonds air wuthless, so I guess it's stealin' th' third degree for I give him ten good Guv'ment bonds to boot!"

The Maine Ice Crop.

From the Portland Press.

The ice went out of the Rangeley Lake April 17 last year, which was the earliest it was ever known to leave. It doubtless won't go out as early this spring, for it has been exceptionally thick this winter and it was reported a few days ago to be 36 inches thick, or several inches thicker than common.

COMFORT FOR RAILROAD MEN

FINE QUARTERS OF THE Y. M. C. A. IN THE PENN. STATION.

A Quarter Mile of Recreation Rooms, Bedrooms and Classrooms Provided Free—The Company Finds It Pays to Supply Such Things for Employees.

President W. C. Brown of the New York Central was quoted recently as saying that the best dollars and cents investment his corporation had made was the money it had given to the railroad branches of the Young Men's Christian Association. Inferentially the late A. J. Cassatt, president of the Pennsylvania, held somewhat the same opinion, for when the Pennsylvania station in New York was projected he insisted that part of the building be set apart for the Y. M. C. A.

This Y. M. C. A. branch, the twenty-seventh to be established along the lines of the Pennsylvania, will be, with the possible exception of the one in the Pennsylvania station at Washington, the largest railroad branch in the country. The rooms were opened on March 9 and within twenty-four hours 200 men and boys had paid their fees and become members. Three hundred or so more employees are thinking of joining.

Membership is restricted to the employees of the Pennsylvania, the Long Island Railroad and the Pullman Car Company to the train crews who between the hours of their flitting in and out of the city welcome a chance for recreation, of study, or a shower bath, maybe, or of forty or eighty winks of sleep in a real bed far removed from the thud of wheels over frogs and rail joints.

This newest home of the Y. M. C. A. spreads over more than 22,000 square feet. The railroad spent between $140,000 and $150,000 on this part of the building and between $20,000 and $30,000 on equipment.

To the visitor scanning the great arched concourse at the Eighth avenue end of the station it may seem that the building is a mere shell covering magnificent distances that leave no room for quarters so ample as those of the railroad Y. M. C. A. But if he will take the elevator near the Eighth avenue entrance and ascend to the top floor, the fourth, he will discover that the architect has tricked him with an illusion. On this floor all along Eighth avenue side and around the corners, paralleling Thirty-first and Thirty-third streets, is a strip some thirty some feet wide and nearly a quarter of a mile long that is the Y. M. C. A.'s peculiar domicile.

The visitor steps from the elevator and finds himself in a reception room suggesting a men's club. Easy chairs and couches promise comfort. Windows, wide and tall, admit a flood of afternoon sunlight and permit one to survey the beginnings of the new post office, the Hudson River and the New Jersey shore.

On the Thirty-first street side of the station, so high above the concourse that no sounds of the trains or shuffling crowds reach the sleepers, is the dormitory. There are 200 rooms, with from four to eight beds in a room. The official name for the beds is bunks, for they are not intended for steady lodgers. They are for trainmen, messengers, Pullman conductors and others who find themselves in New York between trips who need sleep and who at a hotel would have to pay dearly for it.

In the Y. M. C. A. a bed costs a member 10 cents a night or for such time as he occupies it at one stretch and a nonmember 25 cents. The sleepers are so distributed that the crews that have to be called out simultaneously, at midnight, say, are in the same section of the dormitory and can slip away to their trains without waking the others.

From the dormitory the reporter was ushered through a hall seating 350 persons into two classrooms where serious work of the Y. M. C. A. is to be done. The curriculum is not definitely plotted yet, but it is expected that there will be classes in English, business practice and machine drawing with lectures on airbrake construction and other railroad topics by officials of the road and others who can supply informatiom that may help the ambitious trainman to a better job.

The next room visited was the library, whose shelves are to be filled with 1,500 books, including novels and works on railroad subjects. Adjoining it is a reading room 32 by 34 feet. On its tables are popular and technical magazines. Through its windows may be glimpsed that same bit of the river and the New Jersey heights that was observed from the reception room. On the walls hang enlarged photographs of scenes along the lines of the Pennsylvania.

The guide led the way into the apartment, 112 feet long and 17 feet wide, which is called the games room. There a member may play pool at sixteen cents an hour and billiards at 30, about half what he would pay elsewhere. There are also inlaid tables for checkers or chess and there is the old reliable shuffleboard, long a favorite in the Y. M. C. A.

You are told, by the way, that tastes in games differ with geography. Philadelphia, for instance, loves the shuffle board, but the South will have none of it. The Southerner prefers to exercise his intellect working out new combinations in dominoes. In the West pool and billiards are played almost exclusively.

Beside the games room, across a glass partition through which the waiting billiard player may watch the balls roll if he cares to, are two bowling alleys of regulation length.

Thence the visitor was taken to the gymnasium, a room 57 feet long and 45 feet wide, occupying the northwest corner of the station. It has the regulation appliances and a good basketball court.

Its neighbor is a marble lined chamber in which are nine shower baths and 200 dustproof lockers. For the use of soap and towels the association charges five cents. If the bather supplies these things himself he pays nothing. The locker fee is $1.50 a year.

The purpose of it all? The visitor heard something of that when he was taken to the office of the branch and introduced to General Secretary J. M. Rice, who has come from the State secretaryship of the association in West Virginia to take charge of the Y. M. C. A. in the Pennsylvania station. He explained that the general aim of the association was to develop all four sides of a man, spiritual, physical, mental and social, and that the specific aim of the railroad Y. M. C. A. was to make the members more valuable to the railroad and to themselves.

The hours of the railroader are irregular. He has much spare time that he cannot pass at home. The railroad feels itself responsible for his welfare to a degree. Hence its cheerful contribution of such a home as this.

Mr. Rice knows his men. He is now 41 years old. At 15 he picked up telegraphy in a railroad office and became an operator for the Chesapeake and Ohio road. Then he worked for the Baltimore and Ohio and the Norfolk and Western.

For a time he was in the despatcher's office at Hinton, W. Va. Twelve years ago he entered Y. M. C. A. work at Clifton Forge, Va. He was secretary at Knoxville, Tenn., for three years and a half and in Baltimore for seven years. For the last two years he has been State secretary of West Virginia, with headquarters in Parkersburg.

The chairman of the committee of management of the Pennsylvania Station Y. M. C. A. is Enoch Barker, passenger agent of the road in Brooklyn. J. E. Pennypacker is first assistant secretary, F. E. Baldwin is membership secretary and Crosby Matthews is physical director.